7 Strength Training

In this chapter you will learn about:

- Muscle strength.
- Muscle endurance.
- Strength training guidelines.
- Designing a strength training program.
- Proper training techniques.

Muscle strength and endurance training are essential components of overall fitness. Your ability to perform daily tasks and strenuous physical tasks can be enhanced by strength training. As you read through this chapter think about the physical tasks you perform routinely in your job or at home, the strength needed to perform those tasks, and which exercises mimic those tasks. The focus of your strength training routine should be functional or applied strength for job-specific activities, military readiness, and injury prevention. This chapter outlines the principles of muscle strength and muscle endurance training and the proper use of exercise equipment to help you achieve your goals.

Strength versus Endurance

- Muscle strength is the force your muscle can exert against resistance. As you lift and lower a weight your muscle must generate enough force to move that weight.
- Muscle endurance is the ability of your muscle to repeatedly apply force to lift and lower a weight. Muscle endurance describes how long or how many times you can lift and lower a weight.

Benefits of Strength Training

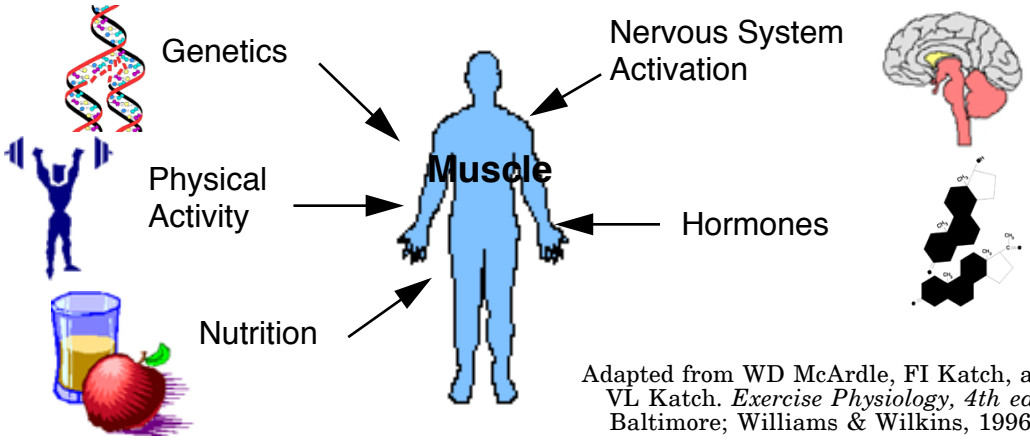
Strength training should complement aerobic workouts because each type of training results in different benefits. General benefits of strength training include:

- Increased muscle strength and muscle endurance, greater lean body mass, less body fat, and higher energy metabolism.
- Increased coordination and greater protection against injury.
- Increased self-esteem and less perceived stress.
- Better performance of physically-demanding, job-related tasks.

Determinants of Muscle Size

Various factors influence muscle size (see Figure 7-1). Although some factors cannot be controlled, two factors that we can control are exercise and nutrition habits (Chapters 3, 4, and 11).

Figure 7-1. Factors that Affect Muscle Size



Adapted from WD McArdle, FI Katch, and VL Katch. *Exercise Physiology, 4th ed.* Baltimore; Williams & Wilkins, 1996.

Men generally have more muscle mass than women, mainly because men produce more testosterone than women. Strength training may increase muscle mass slightly in women; however, a common **misconception** is that strength training will cause women to "bulk up." Importantly, strength training will greatly increase muscle strength and reduce the risks for injury. Moreover, women tend to have poor upper body strength and many military tasks require upper body strength.

Strength Training Guidelines

Training Form

Correct lifting techniques are critical for achieving maximum benefits and preventing injury (see Appendix C). If your form is incorrect, strength training can lead to injury, not strength gains.

- Use minimal weight when learning a new exercise.
- Use a closed grip (fingers and thumbs wrap around the bar or handle and touch each other), and place hands equidistant from the ends of the bar. Load the weights evenly across the bar.
- For free weights, feet should be hip to shoulder width apart, knees slightly bent, and your back should keep its natural curve. Keep your head level and eyes focused straight ahead. If maintaining this posture is difficult than the weight is too heavy.
- For resistance machines, adjust the pads to fit your body so the pads can support you during the lift. Keep your head level and eyes focused straight ahead.
- **Lifts should be slow, smooth, and controlled.** Lift and lower the weight for 2-4 seconds in each direction to ensure that your muscle, not momentum, is moving the weight.
- **Exhale** during the exertion (moving the weight against gravity), and **inhale** when returning to the start position. **Never hold your breath while exercising!**
- Always use a spotter when lifting free weights.

The most common training errors occur when people focus on lifting the weight rather than focusing on stabilizing themselves and controlling the weight. The best way to avoid training mistakes is to ask a staff member at the gym to teach you new exercises and to suggest the best exercises for you based on your fitness level and goals. See Appendix C for examples of common errors in training techniques and how to avoid making them.

FITT Principle Guidelines

Once you are comfortable with the basic training techniques for performing strength exercises, follow the FITT Principle, illustrated in the Physical Activity Pyramid (Chapter 4, Figure 4-2), to set up your routine. The FITT guidelines for strength training are:

- **Frequency** - 2 to 3 times per week for each major muscle group on non-consecutive days.
- **Intensity** - the total weight lifted or the resistance applied.
- **Time** - the duration of the exercise.
- **Type** - equipment used and the exercises performed.

Two terms you need to know are **repetition (rep)** and **set**. A rep is a single lifting and lowering of the weight. For example, one rep of a leg curl is lifting your ankle toward your buttocks, pausing one second, then returning your ankle to the start position. A set is the number of reps performed without stopping to rest. For example, if you perform 10 leg curls, rest for 60 seconds, followed by another 10 leg curls, you would have performed 2 sets, each of 10 leg curls. When recording the number of sets and reps performed, write **"sets x reps"** (i.e., 2x10 for the leg curl example).

Intensity of Exercise

Focus on the intensity of your training only **after** you have perfected your lifting form. The basis of strength training is to gradually increase the amount of weight that you lift during training to ultimately increase the amount of force your muscles are capable of generating. This is called **progressively overloading** the muscle to achieve gains in strength without causing injury. The following intensity guidelines for general strength gains are for beginners, for people who are restarting their routines after a break, and for people learning new exercises.

- Once your form is perfected (page 44), gradually increase the weight you are lifting until you reach a weight that you can lift only 12 times with good form. Finding this 12-rep weight will be trial and error at first.
- Your 12-rep weight will increase as you gain strength, so increase the weight you are lifting appropriately (but no more than 10% each week).
- Start a training routine consisting of one to two sets of 12 reps for each major muscle group (defined in "Type of Exercise" on page 46).

A long-term strength routine of one to two sets of 12 reps is excellent for maintaining and increasing general strength. In addition, this type of routine only takes about 30 minutes to perform. Once you have developed a solid strength and endurance base (after about eight weeks) you may be interested in pursuing more specific training goals. In general, the following guidelines apply to the various types of strength training goals:

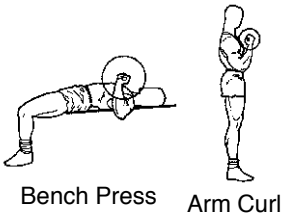
- Muscle endurance - two to three sets, 12-15 reps with a 15-rep weight; 30-60 seconds rest between sets.
- Muscle hypertrophy (increase in muscle mass) - three to six sets, eight to 12 reps with a 12-rep weight; 30-90 seconds rest between sets.
- Muscle strength - three to five sets, two to eight reps with an 8-rep weight; at least 120 seconds rest between sets.

Note: Do not perform maximal lifts when strength training.

Type of Exercise

For maximum benefit and to decrease the risk of injury, pay attention to:

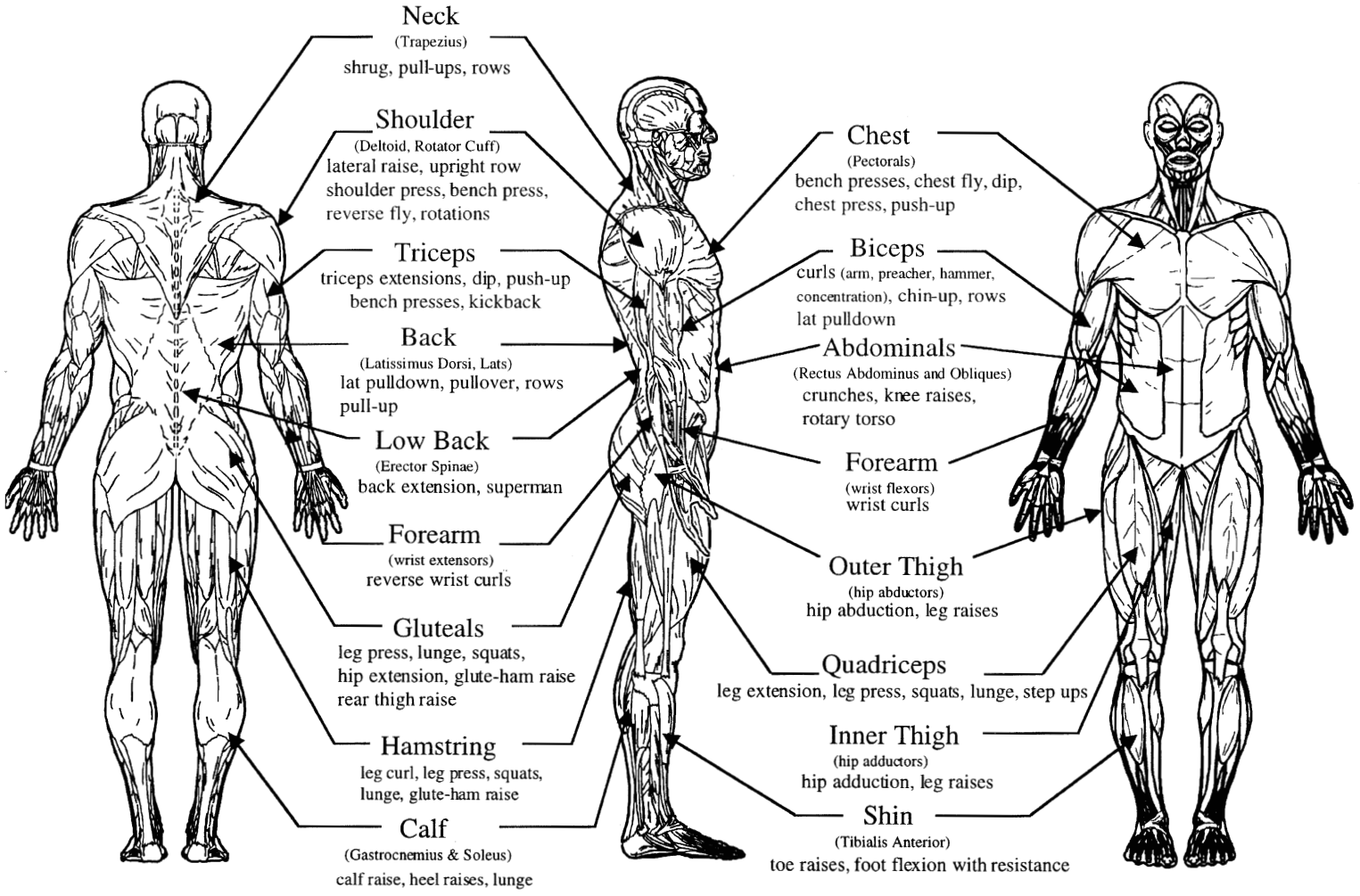
- **Muscle balance** - perform exercises that target the opposing muscle groups across the joints to strengthen the major muscles and improve joint function; e.g., strengthen the biceps and triceps muscles in the upper arm.
- **Exercise selection** - Select at least one exercise for each of the major muscle groups. The **major muscle groups** are the chest, back, shoulders, arms, legs, lower back, and abdominals (abs). (See Figure 7-2 and Worksheet B-2.)



- **Exercise order** - perform multi-joint exercises before single-joint exercises. In a multi-joint exercise more than one joint (per side) moves during the exercise; e.g., your shoulders and elbows move during a bench press. In a single-joint exercise one joint (per side) moves during the exercise; e.g., only your elbow moves during an arm curl. Perform lower back and abdominal exercises at the end of your workout since those muscles are used for balance and posture during other exercises.

Use Worksheet B-2 to design your workout and to record your training progress. Change the exercises you perform for each muscle group every four to eight weeks, even if you keep the same set and rep routine. Changing exercises will overload the muscles differently, increase your strength gains, and alleviate boredom. There are a variety of exercises for each muscle group listed in Figure 7-2. To increase their upper body strength, women should perform exercises that target the back, neck, chest, shoulders and arms.

Figure 7-2. Exercises for Various Muscle Groups



Equipment

Strength training requires minimal personal gear: weights, a pair of supportive shoes, and lifting gloves. A weight lifting belt is only recommended during maximal or near maximal lifts, and is not recommended at all for exercises that do not stress the back. This is because the belt takes over the role of the abdominal muscles in stabilizing the torso, preventing the strengthening of the abdominal muscles.

The most common barbells found in gyms are Olympic style barbells. There are several styles that vary widely in size and weight, so ask a staff member at your gym to help you determine which barbell best suits your needs. In addition, the weight plates to load the barbells come in a variety of sizes and are measured in both pounds (lbs) and kilograms (kg). Pay attention to the weight measurements in your gym; there is a big difference between 10 lbs and 10 kg! Use adjustable collars to keep the plates on the bar.

Choosing which equipment to use depends largely on your goals and training experience. Table 7-1 lists a comparison of free weights and machines to help you with your choice. If you are new to a fitness center or if you are unsure how to work a piece of equipment, ask a fitness center staffer for an orientation. This orientation will help you design a workout routine based on the equipment selection at your gym.

Though this chapter focuses on resistance machines and free weights, resistance for strength training can come from a variety of sources. Other exercise techniques and equipment available for strength training when space and equipment may be limited are outlined in Chapters 8 and 10.

Table 7-1. Free Weights vs. Resistance Machines

Free Weights		Resistance Machines
Low cost and versatile.		Expensive, less versatile, need access to equipment.
Form is crucial; spotter is needed.		Supports the body during the exercise; easy to adjust.
Trains balance and posture; mimics daily activities.		Isolates muscle groups more easily than free weights.
Can perform multi-joint and single-joint exercises.		Machines made for multi-joint and single-joint exercises.
Muscles trained through joint's full range of motion.		Muscle training occurs in a limited range of motion.

Types of Workouts

The following two routines are basic workouts to build muscle strength. Choose the routine that is best for you based on the time available, your goals, your training experience, and your fitness level. More advanced workouts should only be performed once you have a solid muscle strength and endurance base and have perfected your lifting form. For more information on these more advanced routines (such as pyramids, super sets, and split routines) see your Command Fitness Coordinator or a certified fitness professional at your gym.

- **Full body workouts -** All the major muscle groups (as listed in Worksheet B-2) are exercised during a single session. Perform one to two sets of an exercise for each muscle group and rest between sets. This should take 20-45 minutes. For general strength training purposes; workout at least twice a week.
- **Circuit Training -** Combines aerobic and strength exercise stations. Each exercise station takes 30-45 seconds to perform and stations alternate between upper and lower body exercises. The circuit is repeated two or more times per session. Circuit training improves aerobic conditioning and moderately increases strength when performed three times per week. This routine is good for people who have less than 45 minutes to do both aerobic and strength exercises. (See Table 10-2 for an example.)

Use the guidelines in this chapter provided to develop a sound strength training program. Alternate exercises for each muscle group at least every eight weeks to maximize strength gains, enhance job-related fitness, and have fun!